

Firstwind Kahuku Wind Farm Jurisdictional Wetland Determination Study

TMK 56005007 KAHUKU, OʻAHU, HAWAIʻI

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October 2008

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WETLAND DELINEATION SUMMARY

SITE NAME: Firstwind Kahuku Wind Farm TMK 56005007

SITE LOCATION: The site is located adjacent to the town of Kahuku on north shore of the Island

of O'ahu, within the state of Hawai'i.

OWNER: Firstwind

DATE OF SITE VISITS: June 4-5, 2008; June 16, 2008; October 6, 2008

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SUMMARY

SWCA Environmental Consultants (SWCA) was tasked by Firstwind, the developer of the subject property, to identify wetlands subject to Department of the Army jurisdiction under Section 404 of the Clean Water Act. Wetland delineation fieldwork was conducted by SWCA on June 4-5, June 16, and October 6, 2008. SWCA's field studies were conducted utilizing methods prescribed in the US Army Corps of Engineers 1987 Wetlands Delineation Manual, as amended, in accordance with the requirements of US Army Corps of Engineers.

The US Fish and Wildlife Service (USFWS) conducted wetland mapping in Hawai'i based upon the Cowardin et al. (1979) wetland classification schema in 1981. According to the USFWS definition, three wetlands occur within the project parcel. Each of the following was described by USFWS as being palustrine, forested, broad-leafed evergreen, seasonal (PFO3C) wetlands: Ohia'ai Gulch/Ki'i Ditch, Kalaeokahipa Gulch, and an unnamed headwater tributary to James Campbell National Wildlife Refuge (NWR) (paralleling Nudist Camp Road). In addition, the lower reach of Ohia'ai Gulch/Ki'i Ditch, outside of the project boundary, is classified as palustrine, emergent, persistent, seasonally flooded, excavated (PEM1Cx).

No wetlands meeting the three established criteria of hydrophilic vegetation, soils, and water regime were found to occur within the project parcel during the survey by SWCA. However, SWCA determined that intermittent Ohia'ai Gulch and Kalaeokahipa Gulch are likely to be subject to discretionary Department of the Army jurisdiction (in light of the *Rapanos* and *SWANCC* Supreme Court Decisions) because of their significance to the jurisdictional waters at the two units of the James Campbell National Wildlife Refuge (NWR), located immediately downstream of the project property.

1.0 INTRODUCTION TO WETLANDS AND WETLAND DELINEATION

The U.S. Army Corps of Engineers (Corps) derives its regulatory authority over wetlands and waters of the United States from the two Federal laws: Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act (33 CFR Part 328 and 329). Waters of the United States subject to Corps jurisdiction include navigable waters and their tributaries, interstate waters and their tributaries, wetlands adjacent to these waters, and impoundments of these waters. The U.S. Army Corps of Engineers, U.S. Environmental Protection Agency (EPA), and Hawai'i Department of Health (HDOH) define wetlands as: "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swaps, marshes, bogs and similar areas" (Erickson and Puttock 2006).

The Cowardin et al. (1979) definition of wetlands developed by the U.S. Fish and Wildlife Service is the standard for the agency and is the national standard for wetland mapping, monitoring and data reporting. As determined by the Federal Geographic Data Committee, wetlands are "...are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes, (2) the substrate is predominantly undrained hydric soil, and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year."

Wetland jurisdictional boundary determinations involve an assessment of the relationship between indicators of vegetation, soil, and hydrologic regimes. Each is summarized below:

1.1 Vegetation Indicators

The U.S. Fish and Wildlife Service published a *National List of Vascular Plant Species That Occur in Wetlands*. The 1996 National Summary (draft revision) designates a regional wetland indicator status for plant species in Hawai'i which estimates the probability of a species occurring in wetlands versus non-wetlands (USFWS 1997). Plants that are capable of living in anoxic conditions characteristic of inundated or saturated soils are considered hydrophytes if they are classified as OBL, FACW+, FACW, FACW-, FAC+, and FAC (Table 1). If more than 50 percent of the dominant vegetation at a site is hydrophytic, the entire area is considered to have wetland vegetation. The following factors are also listed as supplemental indicators of hydrophytic vegetation: visual observation of plant species growing in areas of prolonged inundation and/or soil saturation; morphological adaptations; technical literature; and physical and reproductive adaptations (Erickson and Puttock 2006).

Table 1. Wetland Plant Indicators	published in the Cor	ps' Wetlands Delineation Manual (1987).
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PLANT INDICATOR	SYMBOL	DESCRIPTION
Obligate Wetland Species	OBL	>99% found in wetlands
Facultative Wetlands Species	FACW	67-99% found in wetlands
Facultative Species	FAC	33-66% found in wetlands
Facultative Upland Species	FACU	1-33% found in wetlands
Obligate Upland Species	UPL	<1% found in wetlands
No Indicator Status	NI	Ignored in count

^{(+) =} wetter than FAC; (-) = drier than FAC; (*) = tentative assignment/more data needed

1.2 Soil Indicators

Hydric soils are defined as soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part (NRCS 2007). Hydric soils are either drained or undrained and are classified as either organic or mineral soils. Soil characteristic are determined in the field by digging 18 inch (45 cm) holes near potential wetland areas and documenting the texture, smell, color, and water level. For sandy soils, the following

features are indicative of hydric soils: high organic content in the surface (A) horizon; streaking of subsurface horizons by organic matter; the presence of organic pans (Erickson and Puttock 2006).

The NRCS National List of Hydric Soils (February 2007) for O'ahu Island includes 13 hydric soils for the island. Soils within TMK 56005007 at Kahuku, O'ahu are mapped by the Natural Resources Conservation Service (Sato el al. 2001). No hydric soils are mapped by NRCS on the project parcel.

1.3 Hydrologic Indicators

Visual observation of inundation, visual observation of soil saturation, watermarks, drift lines, sediment deposition, and drainage patterns are all primary indicators of wetland hydrology. If a single primary indictor is present, the area can be considered to have wetland hydrology. The *Army Corps of Engineers Wetlands Delineation Manual* (1987, updated online version) states that "an area has wetland hydrology if it is inundated or saturated to the surface continually for at least 5% of the growing season." Erickson and Puttock (2006) note that because the growing season in Hawai'i is year-round, this equates to at least 18.5 consecutive days of inundation or saturation per year. Furthermore, regional indicators and secondary indicators can also be used to determine hydrological conditions. For example, the presence of tilapia redds (circular fish nests at the bottom of ponds or streams) is considered a regional indicator for wetland hydrology (Erickson and Puttock 2006).

2.0 REGIONAL BACKGROUND

2.1 Location and Vicinity

The wetland delineation was conducted in the community of Kahuku on the northeastern portion of the island of O'ahu, within the state of Hawai'i. The project area encompasses 506.85 acres (205.11 ha) and ranges from 120 to 535 feet (36.6-163 m) in elevation. The site is accessed by Charlie Road via Kamehameha Highway. It is bounded on the east and south by pasture and agricultural lands along the Kamehameha Highway, on the north by undeveloped military reservation land, and on the west by rough mountainous land (Hobdy 2007). Notable adjacent land uses include the Turtle Bay Resort, located about 0.5 mi (0.8 km) northwest of the site, and the Kuilima Wastewater Treatment Plant, located about 1 mi (1.6 km) northwest of the site. In addition, the James Campbell National Wildlife Refuge (NWR), which consists of two wetland units roughly two miles (3.2 km) apart: the Ki'i Unit (107.5 acres) and the Punamano Unit (37.5 acres), is located makai (seaward) of the property about a mile away below Kamehameha Highway (Figure 1).

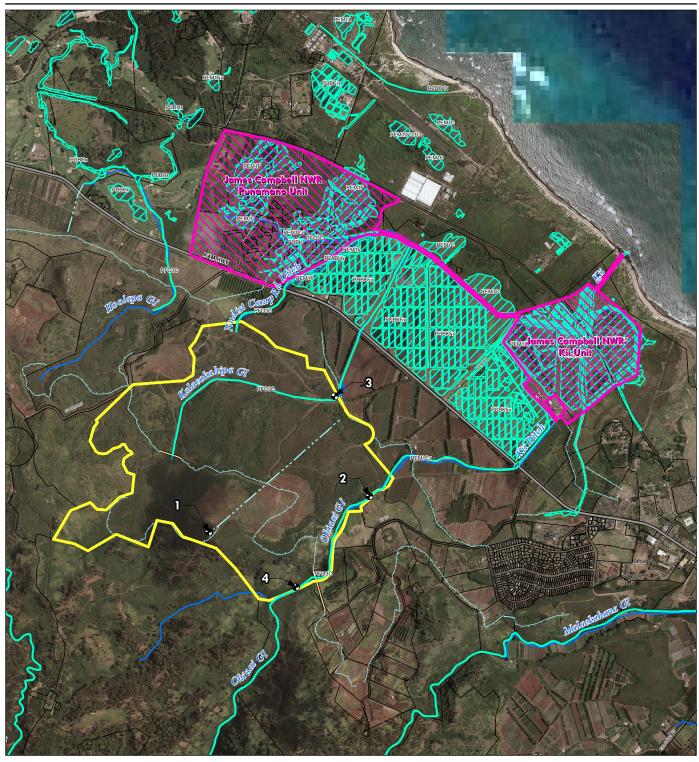
The climate is characteristic of lowland areas on the windward side of Oʻahu, with annual temperatures from 20.5 to 27.1°C (68.9-80.8°F) and annual precipitation between 37.88 and 40.86 inches (96.2 and 103.8 cm) (NOAA 2002, DBEDT 2007). Due to its location on the northern corner of Oʻahu, Kahuku is considered a high wind energy site (Lau and Mink 2006). Prevailing northeasterly trade winds are present nearly 90 percent of the year in Kahuku and the southerly Kona winds are present approximately 10 percent of the year (Smith, Young & Assoc. 1990).

2.2 Geology and Soils

O'ahu, the third largest island in the Hawaiian archipelago, was created by several geological processes including shield-building volcanism, subsidence, weathering, erosion, sedimentation, and rejuvenated volcanism (Hunt 1996). The island is mostly composed of the heavily eroded remnants of two large Pliocene shield volcanoes - Wai'anae and Ko'olau (Juvik and Juvik 1998).

The project site is located at the foot of the Koʻolau Mountains. This mountain range was created by the Koʻolau Volcano which formed about 2.2 to 2.5 million years ago (Lau and Mink 2006). Koʻolau is comprised of shield lavas, referred to as Koʻolau Basalt, as well as rejuvenated stages, termed the Honolulu Volcanics (Juvik and Juvik 1998). The Kahuku area of Oʻahu has a complex geological history. Eroded shield volcanoes, such as the Koʻolau Volcano, typically have dike complexes of basaltic material associated with active rift zones. These massive sheets of rock extend vertically into the lava flows, inhibiting normal groundwater flow (Hunt 1996).

SWCA Inc. FirstWind



Legend

Wetland Survey Points

TMK Parcel 56005007

☐ TMK Parcels

USFWS Wetland Inventory/ Cowardin Classification

James Campbell National Wildlife Refuge

Hydrology

AQUEDUCT

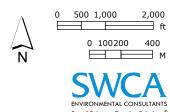
DITCH OR CANAL

FLUME

SIPHON STREAM

STREAM, UNDERPASS

Figure 1 Hydrology and Sampling Points at the Kahuku Wind Farm Site



The majority of the site is underlain Koʻolau Basalt lava flows ranging from 1.8 to 3 million year old. Near the makai boundary of the property older dune deposits, as well as lagoon and reef deposits (limestone and mudstone) are present. In addition, a narrow strip of alluvium sand and gravel underlies a portion of the property, roughly bisecting the middle of the parcel. No unique or unusual geologic resources or conditions are known to occur onsite.

Soils on the island of O'ahu were classified and defined by the U.S. Department of Agriculture (USDA) Soil Conservation Service (Foote et al. 1972) and Natural Resource Conservation Service (NRCS). According to the NRCS National Hydric Soils List, none of the soils on the unit are considered hydric. Soil types and features identified by the USDA on the property are listed in Table 2.

Table 2. Soil types found on the Firstwind property based on classifications from Foote et al. (1972).

	Soil Type	Key Characteristics	Percent
PeC	Paumalu silty clay,	Permeability: moderately rapid;	
	8 to 15 percent slopes	Runoff: slow to medium;	19.26%
		Erosion: slight to moderate	
LaB	Lahaina silty clay,	Permeability: moderate;	
	3 to 7 percent slopes	Runoff: slow;	17.43%
		Erosion: slight.	
LaC	Lahaina silty clay,	Permeability: moderate;	
	7 to 15 percent slopes	Runoff: medium;	16.53%
	_	Erosion: moderate.	
CR	Coral Outcrop		11.46%
PeB	Paumalu silty clay,	Permeability: moderately rapid;	
	3 to 8 percent slopes	Runoff: slow	10.14%
		Erosion: slight	
PZ	Paumalu-badland	Permeability: moderately rapid;	
	complex	Runoff: medium to rapid;	5.55%
		Erosion: moderate to severe.	
PeD	Paumalu silty clay,	Permeability: moderately rapid;	
	15 to 25 percent	Runoff: medium;	4.68%
	slopes	Erosion: moderate.	
PeE	Paumalu silty clay,	Permeability: moderately rapid;	
	25 to 40 percent	Runoff: medium to rapid;	3.78%
	slopes	Erosion: moderate to severe.	
KaC	Kaena clay,	Permeability: slow;	
	6 to 12 percent slopes	Runoff: slow to medium;	3.60%
1/07		Erosion: slight to moderate.	
KPZ	Kemoo-badland	Permeability: moderate/moderately rapid;	4 770/
	complex	Runoff: medium to rapid;	1.77%
14 5		Erosion: moderate to severe.	
KanE	Kaena very stony clay,	Permeability: slow;	1 200/
	10 to 35 percent	Runoff: medium to rapid;	1.30%
14 - D	slopes	Erosion: moderate to severe.	
KpD	Kemoo silty clay,	Permeability: moderate/moderately rapid; Runoff: medium;	1.24%
	12 to 20 percent		1.24%
HeB	slopes Haleiwa silty clay,	Erosion: moderate. Permeability: moderate;	
пев	2 to 6 percent slopes	Runoff: slow;	0.81%
	2 to 6 percent slopes	Erosion: slight.	0.0170
WkB	Waialua silty clay,	Permeability: moderate;	+
VVKD	3 to 8 percent slopes	Runoff: slow;	0.79%
	1 2 to 6 percent slopes	Erosion: slight.	0.7970
KaeC	Kaena stony clay,	Permeability: slow;	
Naec	6 to 12 percent slopes	Runoff: slow to medium;	0.60%
	0 to 12 percent slopes	Erosion: slight to moderate.	0.0070
L		LIOSIOII. SIIGIIL LO IIIOUEFALE.	

W	Water > 40 acres*		0.48%
PeF	Paumalu silty clay,	Permeability: moderately rapid;	
	40 to 70 percent	Runoff: rapid;	0.31%
	slopes	Erosion: severe.	
WkA	Waialua silty clay, 0 to	Permeability: moderate;	
	3 percent slopes	Runoff: slow;	0.21%
	-	Erosion: slight.	
KpC	Kemoo silty clay,	Permeability: moderate/moderately rapid;	
	6 to 12 percent slopes	Runoff: medium;	0.06%
		Erosion: slight to moderate.	

2.3 Hydrology and Drainage

Hydrologic processes in Hawai'i are often highly dependent on the climatic and geological features of the area. For example, stream flow is influenced by rainfall and wind patterns. The majority of the perennial streams (84 percent) on O'ahu are located in the Ko'olau Mountains because the prevailing trade wind patterns produce a larger amount of precipitation compared to the leeward side of the island (Polhemus 2007). In addition, permeable underlying rock may cause some streams on O'ahu to have lengthy dry reaches under natural conditions.

Streams in the Kahuku area are considered to be naturally intermittent (Polhemus et al. 1992) and are typically short and steep, with permeable upland soils creating rapid infiltration into the Koʻolau aquifer. As a result, streamflow in the lowland areas near the NWR have periods of high peak floods and little base flow (Hunt and De Carlo 2000). Ohiaʻai, Kalaeokahipa, and Hoolapa are intermittent streams in the Kahuku area (Smith, Young & Assoc. 1990). Ohiaʻai Gulch, which is referred to as Kiʻi ditch/stream makai of Kamehameha Highway, has a drainage area of 2.48 mi² and enters the western portion of the Kiʻi Unit. Kalaeokahipa Gulch flows east into the Kiʻi Unit of the NWR and has a drainage area of 1.04 mi² (Hunt and De Carlo 2000). Nudist Camp Road Ditch drains a 0.022 mi² into the Punamano Unit of the refuge. Nearby Hoolapa Gulch drains west into Punahoolapa marsh, located west of the NWR (Hunt and De Carlo 2000) (Figure 1).

In the late 1970s the U.S. Fish and Wildlife Service Division of Ecological Services biologists used orthophoto quadrangle maps and spot field checks to map wetlands in Hawai'i as a part of the National Wetlands Inventory (NWI) Program according to the Cowardin et al. (1979) classification system. In the generalized wetland maps prepared by the NWI, a single wetland types was identified within the project area: palustrine, forested, broad-leafed evergreen, seasonal (PFO3C) wetlands.

The Flood Insurance Rate Maps (FIRM) prepared by the Federal Emergency Management Agency's National Flood Insurance Program depicts flood hazard areas through the state. The maps classify land into four zones depending on the expectation of flood inundation. The site is located in Flood Zone D (undetermined); however, the property is known to have a tendency to flood. The applicant is working to alter the current system by establishing drainage ditches (USFWS 2007).

2.4 Flora and Fauna

The majority of the project area (about 80%) is covered with dense brush and trees, with smaller open areas vegetated with grasses and herbaceous species (Hobdy 2007). The abundant and common species are non-native plants and few native plant species exist onsite as a result of topsoil disturbance from sugar production and cattle grazing. Native species are generally located on rocky outcrops and on the exposed ridge tops in the upper portion of the property.

A total of 18 bird species have been recorded within the Kahuku site (SWCA, unpub. data). Several of these birds are protected under the Migratory Bird Treaty Act (MTBA), including the great frigate bird (*Fregata minor*), Pacific golden plover (*Pluviaslis dominica*) and ruddy turnstone (*Arenaria interpres*).

^{*} Land uses on the property since the publication of these soils classifications in 1972 likely altered the hydrology of the site; no standing water was observed at these locations during the surveys.

No federally listed endangered, threatened, or candidate species presently occur on the site; however, several endangered and threatened bird species are known to occur on adjacent properties. This includes four species of endangered waterbirds: the Hawaiian duck (*Anas wyvilliana*) or koloa maoli, the Hawaiian coot (*Fulica alai*) or 'ala eke'oke'o, the Hawaiian common moorhen (*Gallinula chloropus sandvicensis*) or 'alae 'ula, and the Hawaiian stilt (*Himantopus mexicanus knudseni*) or ae'o.

2.5 Land Use

The project site was used for sugar production during the late 1800's. Since sugar cultivation ended in roughly the late 1900's, the area has primarily been used for cattle grazing (Hobdy 2007).

Under The State Land Use Law (Act 187), Hawaii Revised Statute Chapter 205, all lands and waters in the State are classified into four districts: Agriculture, Rural, Conservation, and Urban. Conservation Districts, under the jurisdiction of DLNR, are further divided into five subzones: Protective, Limited, Resource, General and Special (Hawaii Administration Rules, Title 13, Chapter 5). The State of Hawaii Land Use District Boundaries are governed by the City and County Land Use Ordinance. The area is designated as an Agricultural district by the State of Hawaii Land Use District Boundaries Map.

In addition, land use is dictated by zoning ordinances from the City and County. The City and County of Honolulu zoning ordinance defines the area as AG-1 Restrict Agricultural District. This designation is intended to preserve "important agricultural lands" for agricultural functions such as the production of food, feed, forage, fiber crops and horticultural plants (City and County of Honolulu, Land Use Ordinance, Chapter 21). A wind farm is permitted in this zoning area with a Conditional Use Permit (CUP) (USFWS 2007).

3.0 METHODOLOGY

SWCA employed methods for determining the presence of wetlands and delineating wetland boundaries prescribed by the *Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987, updated online version) as required by the Honolulu District, US Army Engineers and the City and County of Honolulu. Wetland delineation fieldwork was conducted by SWCA biologists and staff on June 4-5 and June 16, with supplemental data collected on October 6, 2008. Wetland determination data sheets prepared on these dates appear in Appendix A.

All low lying areas and intermittent streams on the Firstwind project site at Kahuku were walked through on June 4-5 and June 16, 2008 to determine the presence of wetlands based upon the three wetland criteria: a predominance of hydrophilic vegetation, hydric soils, and wetland hydrology (COE 1987). Numbered sampling points and soil cores were established in areas where the NWI had identified wetlands on October 6, 2008 (Figure 1).

3.1 Vegetation

Individual plants species and floral communities were identified throughout the property. In addition, the dominant plant species was recorded at each of the four sampling points. Species cumulatively exceeding 50% of the total cover and those with 20% of the total percent cover were considered dominant. These species were then compared with the regional indicator designated for the state of Hawai'i. Plant taxonomy and synonymy follows Wagner et al. (1999).

3.2 Soils

Soils were obtained by digging test pits and taking sediment cores at each of the sampling points. SWCA biologists identified soil samples in the field with standardized color chips (*Munsell Soil Color Charts*, Kollmorgen Corporation, 1998 revised washable edition) of hue, value, and chroma and by texture (sand, silt, clay, loam, muck, and peat). Anaerobic soil conditions and the presence of gleyed soils were of particular interest.

3.3 Hydrology

Both primary and secondary hydrology indicators were evaluated at each sampling site. Biologists searched for inundation, saturation, water marks, drift lines, crust, soil cracks, hydrogen sulfide odor, and drainage patterns.

4.0 FINDINGS

4.1 Vegetation

A list of vegetation noted onsite by SWCA and Hobdy (2007) is included in Appendix B. A total of 50 plant species were observed on site. The vegetation in the upland regions of the surveyed area are mostly comprised of dense koa haole (*Leucaena leucocephala*) trees with a mix of grass and herbaceous plants in the understory. Cocklebur (*Xanthium strumarium*), allspice (*Pimenta dioica*) and kolomona (*Senna surattensis*) were some of the other common tree/ shrub species through the surveyed area (Figure 2). Only a few native species were found, such as 'ala'ala wai nui (*Peperomia blanda*) and 'iliee (*Plumbago zeylanica*) on rocky outcrops and 'akia (*Wikstroemia oahuensis*) and u'ulei (*Osteomeles anthyllidifolia*) on the exposed ridge tops in the upper portion of the property. The upland region also comprised of some large patches of open and eroded areas with no vegetation other than few herbaceous species such as Jamaican vervain (*Stachytarpheta jamaicensis*), 'uhaloa (*Waltheria indica*) and *Bidens alba*. There was a plateau region in the southern portion of the property that was mostly an ironwood (*Casuarina equisetifolia*) and sisal (*Agave sisalana*) forest with some 'akia in the understory.

The vegetation in the ditches and canals and the sediment stream beds was dominated by parasol leaf tree (*Macaranga tanarius*) and ficus species (such as *Ficus macrophylla*), especially along the rocky walls and with relatively few species in the shaded understory. Castor bean (*Ricinus communis*), *Pluchea* species, guinea grass (*Panicum maximum*), and kolomona were also common in the gulch areas, ditches and canals. There was a large patch of hau (*Hibiscus tiliaceus*) and Christmas berry (*Schinus terebinthifolius*) thicket in the gulch area near the confluence of the two streams. The rocky stream beds were mostly dominated by guinea grass with rare occurrence of species such as honohono (*Commelina diffusa*) and coral berry (*Rivina humilis*). *Ficus* species, koa haole and Christmas berry trees mostly dominated the banks of the two streams.

None of the 50 plant species recorded onsite are obligate wetland species. Of the 50 species, 32 species did not occur on the regional list for Hawai'i – indicating that these are all upland species in Hawai'i. Based on the National List of Plant Species that Occur in Wetlands: Hawai'i (Reed 1988), of the remaining 18 species are given the following classification on the regional list: nine species are classified as Facultative Upland (FACU); two species are Facultative Upland with lower frequency of occurrence in wetlands in Hawai'i (FAC-), two species are Facultative (FAC); two species are Facultative Upland but with tentative assignment due to lack of information (FACU*), 1 Facultative with tentative assignment due to lack of information (FAC*) and 2 species with no information to determine indicator status (NI).

4.2 Soils

None of the soils on the unit are considered hydric and no hydric soil conditions were observed during the surveys.

4.3 Hydrology

Only one small wetted area was found by SWCA during the surveys. The ponded area was located in the upper portion of Ohia'ai Gulch, just below Sampling Point 4 (Figure 1). On June 4, 2008, this less than 1 sq. meter area bounded by several medium sized boulders had approximately 3 inches of water. On the previous survey dates, no water was present in this depression, although water marks were evident on the boulders (Figure 3). Except in this small area, no flooding or ponding was observed on the parcel in the gulches or in other areas of the parcel.



Figure 2. Typical vegetation on the Firstwind property.



Figure 3. Small wetted area in the upper portion of Ohia'ai Gulch.

4.4 Sampling points

Four sampling points were studied by SWCA on October 6, 2008 (Figure 1). SWCA assigned a number to each of the areas and documented the three criteria, as explained in section 3.0. Each sampling point is described below and the dominant plant species present at each site are followed by the regional indicator status, as described in Table 1.

Sampling Point 1

Sampling Point 1 is located in the vicinity of the former aqueduct, as indicated on the 1998 USGS Kahuku Quad map. This point is found along the southern boundary of the property. Koa haole (*Leucaena leucocephala*) (UPL), allspice (*Pimenta dioica*) (--),† kolomona (*Senna surattensis*) (UPL), and guinea grass (*Panicum maximum*) (FACU) are the dominate plant species at this site (Figure 4). Although the USDA Soil Conservation Service (Foote et al. 1972) defines this area as water, no water or hydric soils were observed in this location. A test pit dug to a depth of 35.6 cm (14 in) and a soil core to a depth of 20 cm (7.9 in) revealed very fine soil, with a 7.5 YR hue, value of 2.5, and a chroma of 3 (7.5 YR 2.5/3) (Figures 5 and 6). The soil has a high iron content as indicated by its red color. No hydrology indicators were present at the site.

Sampling Point 2

Sampling Point 2 is located in the lower reaches of Ohia'ai Gulch along the eastern property boundary. A large coral outcrop area lies adjacent to this site. The dominant plants in this area include the following: guinea grass (FACU), hau (*Hibiscus tiliaceus*) (FACW), koa haole (UPL), and Moreton Bay fig (*Ficus macrophylla*) (--) (Figure 7). Soils at 12 cm (4.7 in) and 38 cm (15 in) below the surface were generally found to be 2.5 YR, with both a value and chroma of 3 (2.5 YR 3/3) (Figures 8 and 9). The drainage area is conspicuous due to the de-vegetated stream bed contrasting the raised stream banks lined with dense strands of guinea grass. No water was present in the stream bed and the presence of debris and small koa haole seedlings suggest there has not been a recent flow at this location.



Figure 4. Sampling Point 1.

^{† (--)} means that the indicator status was not included in the 1996 National Summary List for Hawai'i.



Figure 5. Soil core at Sampling Point 1.



Figure 6. Soil pit dug at Sampling Point 1.



Figure 7. Sampling Point 2.



Figure 8. Soil core at Sampling Point 2.



Figure 9. Soil pit dug at Sampling Point 2.

Sampling Point 3

Sampling Point 3 is located at the bottom of Kalaeokahipa Gulch at an elevation of roughly 93 ft. Cocklebur (*Xanthium strumarium*), guinea grass (FACU), Jamaican vervain (*Stachytarpheta jamaicensis*) (FACU), *Sida rhombifolia* (FACU), Bermuda grass (*Cynodon dactylon*) (FACU), and pea aubergine (*Solanum torvum*) (--) are the dominant plant species (Figure 10). According to Foote et al. (1972), the soils at this location are considered Lahaina silty clay, 3 to 7 percent slopes. Coring and pit digging (Figure 11) to a depth of 14 cm (5.5 in) and 28 cm (11 in), respectively, revealed a middle yellow-red hue, with a value of 3 and a chroma of 3 (5 YR 3/3). Similar to Sampling Point 1, the soil at this site contains a large amount of iron oxide. The drainage area is demarcated by the lower lying stream bed compared to the elevated banks. However, it is not likely that this area has flowed recently due to the presence of mature vegetation in the stream bed.

Sampling Point 4

Sampling Point 4 is located with Ohia'ai Gulch, further upstream from Sampling Point 2, near the southeastern corner of the property. The dominant vegetation at the site is guinea grass (FACU), koa haole (UPL), and Christmas berry (*Schinus terebinthifolius*) (FACU-). The stream bed in this area is mostly lined with large pebbles and small boulders (Figure 12). A soil core and test pit was possible in a clear area of the stream bed (Figures 13 and 14). Soils at 12 cm (4.7 in) and 25.4 cm (10 in) below the surface had a middle yellow-red hue, with a value of 5 and a chroma of 4 (5 YR 5/4). Highly exposed koa haole tree roots were present along the elevated stream banks (Figure 15). The stream bed was largely devoid of vegetation.

5.0 UPLANDS

None of the areas on the parcel meet the criteria for hydrophilic vegetation, hydric soils, and wetland hydrology; therefore, the entire project parcel is considered upland.



Figure 10. Sampling Point 3, showing elevated stream bank on right.



Figure 11. Soil pit dug at Sampling Point 3.



Figure 12. Sampling Point 4.



Figure 13. Soil core at Sampling Point 4.



Figure 14. Soil pit dug at Sampling Point 4.



Figure 15. Exposed koa haole tree roots along the elevated banks of Ohia'ai Gulch.

6.0 CONCLUSION

Wetlands and waters (streams) of the U.S. are regulated by the U.S. Army Corps of Engineers (Corps) under Section 404 of the Clean Water Act. The following are considered jurisdictional waters and are therefore subject to agency authority:

- Traditional navigable waters (TNW);
- Wetlands adjacent to TNW;
- Non-navigable tributaries of TNW that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally;
- Wetlands that directly abut such tributaries.

Per the Rapanos v. United States Supreme Court Decision and Solid Waste Agency of Northern Cook County (SWANCC) v. U.S. Army Corps of Engineers Supreme Court Decision, waters are also considered jurisdictional if they have a "significant nexus" with a TNW. A significant nexus is determined by assessing if the flow characteristics and function of the tributary and the functions performed by wetlands adjacent to the tributary significantly affect the chemical, physical, and biological integrity of the downstream TNW.

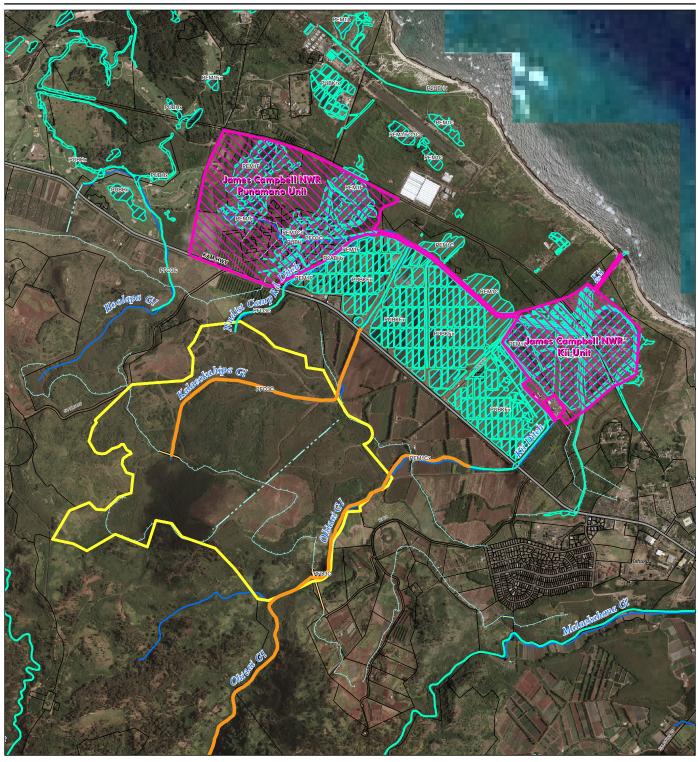
No wetlands meeting the three established criteria of hydrophilic vegetation, soils, and water regime were found to occur within the project parcel. In addition, streams and tributaries within the property are intermittent and therefore do not have continuous or seasonal flow.

The two intermittent streams, Ohia'ai Gulch and Kalaeokahipa Gulch, may be subject to discretionary Department of the Army jurisdiction due to their "significant nexus" with the traditional navigable waters of the James Campbell National Wildlife Refuge (Hunt and DeCarlo 2000) (Figure 16). Any proposed impacts jurisdictional wetlands or waters identified in this report will require submittal of a wetland removal/fill permit application and a wetland mitigation plan to the Honolulu District, US Army Engineers.

7.0 LIMITATIONS

The services provided under this contract as described in this report include professional opinions and judgments based on data collected. These services were provided according to generally accepted practices of the environmental profession. The methodology for determining the presence of wetlands and delineating wetland boundaries follows the routine wetland determination methodology and plant community approach of the Army Corps of Engineers Wetlands Delineation Manual (1987, updated online version). The conclusions drawn in this report represent our best professional judgment after examination of the site conditions and background information. SWCA recommend that our report be submitted to Honolulu District, US Army Engineers for certification of our findings.

SWCA Inc. FirstWind



Probable jurisdictional wetland based on significant nexus determination by ACOE Honolulu District

Legend

TMK Parcel 56005007

☐ TMK Parcels

USFWS Wetland Inventory/ Cowardin Classification

James Campbell National Wildlife Refuge

Hydrology

AQUEDUCT

DITCH OR CANAL

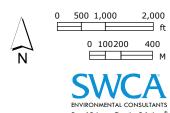
FLUME

SIPHON

STREAM

STREAM, UNDERPASS

Figure 2 Probable Jurisdiction Wetlands at the Kahuku Wind Farm Site



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Wagner, W.L., D.R. Herbst and S.H. Sohmer. 1999. Manual of the flowering plants of Hawai'i, Volumes I & II. Revised edition. University of Hawai'i Press: Honolulu, HI.

DATA FORM ROUTINE WETLAND DETERMINATION

(1987 COE Wetlands Delineation Manual)

Project/Site: Kahuku Windfarm Applicant/Owner: Firstwind Investigator: Thair I Taira Do Normal Circumstances exist on the site? Is the site significantly disturbed (Atypical Situation) Is the area a potential Problem Area? (If needed, explain on reverse.)	Yes No	Date: 10-10-2008 County: Howolulu State: Ha waii Community ID: 1 Transect ID: Plot ID:	Ez:40pn
Dominant Plant Species Stratum Indicator 1. Leu Caen a Leu Co Cephala UPL 2. Senna Suratten SIS UPL 3. Primenta di DICA 4. Panicum Maximum FACU 5. 6. 7. 8. Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). Remarks: MOSHY bave Ground; for	9. 10. 11. 12. 13. 14. 15. 16.	Stratum Indicator	
HYDROLOGY Recorded Data (Describe in Remarks): Stream, Lake, or Tide Gauge Aerial Photographs Other No Recorded Data Available Field Observations: Depth of Surface Water: (in.) Depth to Free Water in Pit: (in.) Depth to Saturated Soil: (in.) Remarks:	Wetland Hydrology Indicato Primary Indicators: Inundated Saturated in Upper Water Marks Drift Lines Sediment Deposits Drainage Patterns Secondary Indicators (2 Oxidized Root Cha Water-Stained Lea Local Soil Survey I FAC-Neutral Test Other (Explain in R	r 12 Inches s in Wetlands or more required): annels in Upper 12 Inches aves Data Remarks)	

SOILS

Map Unit Name (Series and Phase): Taxonomy (Subgroup):	Drainage Class: Field Observations Confirm Mapped Type? Yes No
Profile Description: Depth (inches) Horizon (Munsell Moist) (Munsell Moist) 7.5 P. 2.5 3 Size/Contrast	the state of a state of the sta
Hydric Soil Indicators:	
Histosol Concretions Histic Epipedon High Organic Content in Surfa Sulfidic Odor Organic Streaking in Sandy St Aquic Moisture Regime Listed on Local Hydric Soils Li Reducing Conditions Listed on National Hydric Soils Gleyed or Low-Chroma Colors Other (Explain in Remarks)	oils ist
Remarks: Iron content high Soil pit dug to 14 inches (35.4)	9
Soil pit dug to 14 inches (35.4	e cm)

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Wetland Hydrology Present? Hydric Soils Present?	Yes (Circle) Yes (No) Yes (No)	ls this Sampling Point Within a Wetland?	(Circle)
Remarks:			
·			

Approved by HQUSACE 3/92

DATA FORM ROUTINE WETLAND DETERMINATION

(1987 COE Wetlands Delineation Manual)

Project/Site: Kahwku Windfavim Applicant/Owner: Firstwind Investigator: Phank/ Tai va		Date: W-10-2008 County: Honoluly State: H	@3:00pm
Do Normal Circumstances exist on the site? Is the site significantly disturbed (Atypical Situation)' Is the area a potential Problem Area? (If needed, explain on reverse.)	Yes No Yes No Yes No	Community ID: 2 Transect ID: Plot ID:	
GPS Pt. Gleb VEGETATION			_
Dominant Plant Species Stratum Indicator 1. GUINEA GYCUS FACU 2. FICUS MACROPHYILA 3. KUA HAVIE USPL 4. HAVISCUS FILIALEUS FACW 5. 6. 7. 8. Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). Remarks:	9	Stratum Indicator	
Recorded Data (Describe in Remarks): Stream, Lake, or Tide Gauge Aerial Photographs Other No Recorded Data Available Field Observations: Depth of Surface Water: Depth to Free Water in Pit: Depth to Saturated Soil: (in.)	Wetland Hydrology Indicato Primary Indicators:Inundated Saturated in Upper Water Marks Drift Lines Sediment Deposits Drainage Patterns Secondary Indicators (2 Oxidized Root Cha Water-Stained Lea Local Soil Survey I FAC-Neutral Test Other (Explain in F	s in Wetlands or more required): annels in Upper 12 Inches aves	
Remarks: Within Ohna'ai Guich Delous William Stream bed		naximum along ut no worters	

belons within stream bed; but small stedling showing no vecent flow Appendix B Blank and Example Data Forms

SOILS

Map Unit Name (Series and Phase):	Drainage Class: Field Observations Confirm Mapped Type? Yes No			
Profile Description: Depth (inches) Horizon (Munsell Moist) (Munsell Moist) 2:91233 Mottle Abundan Size/Contrast	the control of the co			
Hydric Soil Indicators: Histosol Histosol Histic Epipedon Sulfidic Odor Aquic Moisture Regime Reducing Conditions Gleyed or Low-Chroma Colors High Organic Content in Surface Layer in Sandy Soils Organic Streaking in Sandy Soils Listed on Local Hydric Soils List Listed on National Hydric Soils List Other (Explain in Remarks)				
Remarks: COVR to 120 mm (4.71n) PIT to 15 inches (38 cm) 4 WON	e.			

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Wetland Hydrology Present? Hydric Soils Present?	Yes No (Circle) Yes No Yes	ls this Sampling Point Within a Wetland?	(Circle) Yes No
Remarks:			
· ·			

Approved by HQUSACE 3/92

DATA FORM ROUTINE WETLAND DETERMINATION

(1987 COE Wetlands Delineation Manual)

Project/Site: Kahuku Windfarm Applicant/Owner: Firstwind Investigator: Thair / Taira	Date: i0-6-2608 County: Honoluly State: Hawaii		
Do Normal Circumstances exist on the site? Is the site significantly disturbed (Atypical Situation) Is the area a potential Problem Area? (If needed, explain on reverse.)	Community ID: Transect ID: Plot ID:		
GPS PA. 667 VEGETATION			
Dominant Plant Species Stratum Indicator 1. Xan Humanum FAC U 2. Sida rhambifolia IFAC U 3. Cynodyn dactylon FAC U 4. Sfachy farpheta jamaucensis FAC U 5. Panic um maximum FAC U 6. Splanum torvum 7 8 Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). Remarks:	9	Stratum Indicator	
Recorded Data (Describe in Remarks): Stream, Lake, or Tide Gauge Aerial Photographs Other No Recorded Data Available Field Observations: Depth of Surface Water: Depth to Free Water in Pit: Depth to Saturated Soil: Remarks: Describe in Remarks): (in.) (in.) Remarks: Remarks: Remarks: Remarks: Remarks	Wetland Hydrology Indicato Primary Indicators:	r 12 Inches s in Wetlands or more required): annels in Upper 12 Inches aves Data	

SOILS

Map Unit Name (Series and Phase): Taxonomy (Subgroup):			Field	nage Class: d Observations irm Mapped Type? Yes No	
Profile Description: Depth (inches) Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)		Texture, Concretions, Structure, etc.	
Hydric Soil Indicators: Histosol Histic Epipedon Sulfidic Odor Aquic Moisture R Reducing Conditi Gleyed or Low-Cl	ions	Organic St Listed on L Listed on N	ns inic Content in Surface Laye treaking in Sandy Soils Local Hydric Soils List National Hydric Soils List olain in Remarks)	er in Sandy Soils	
	en contract to the contract to	(5.5)	cm)		

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Wetland Hydrology Present? Hydric Soils Present?	Yes No (Circle) Yes No Yes No	ls this Sampling Point Within a Wetland?	(Circle) Yes No
Remarks:			

Approved by HQUSACE 3/92

DATA FORM ROUTINE WETLAND DETERMINATION

(1987 COE Wetlands Delineation Manual)

Project/Site: Kahuku Wind fav m Applicant/Owner: Fiv8-Wind Investigator: Thair / Taira	County: Honolulu State:
Do Normal Circumstances exist on the site? Is the site significantly disturbed (Atypical Situation) Is the area a potential Problem Area? (If needed, explain on reverse.)	? Yes No
GPS pt. 668 EGETATION	
Dominant Plant Species 1. GIMNEA GRASS 2. KOA MAOLE 3. SCHINUS TEVEBINTAFOLIUS FACU 4	Dominant Plant Species Stratum Indicator 9
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). Remarks: HYDROLOGY	
Recorded Data (Describe in Remarks): Stream, Lake, or Tide Gauge Aerial Photographs Other No Recorded Data Available Field Observations:	Wetland Hydrology Indicators: Primary Indicators: Inundated Saturated in Upper 12 Inches Water Marks Drift Lines Sediment Deposits Drainage Patterns in Wetlands Secondary Indicators (2 or more required): Oxidized Root Channels in Upper 12 Inches
Depth of Surface Water:(in.) Depth to Free Water in Pit:(in.) Depth to Saturated Soil:(in.)	Water-Stained Leaves Local Soil Survey Data FAC-Neutral Test Other (Explain in Remarks)
Remarks: Within Ohua'ai Guich Tyle vods exposed	dlong banks

00	II C

Map Unit Name (Series and Phase): Taxonomy (Subgroup):			Fiel	ninage Class: ld Observations nfirm Mapped Type? Yes No	
Profile Description: Depth (inches) Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.	
	5/K 5/4				
	8.2				
Hydric Soil Indicators: Histosol Histic Epipedon Sulfidic Odor Aquic Moisture I Reducing Condi	Regime ítions	Urganic Listed or Listed or	ions ganic Content in Surface Lay Streaking in Sandy Soils n Local Hydric Soils List n National Hydric Soils List xplain in Remarks)	er in Sandy Soils	
Remarks: OVE		n (4.7 ches (25			
strea	m bottom	mostly d	lined with	voeks	

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Wetland Hydrology Present? Hydric Soils Present?	Yes No Yes No	ls this Sampling Point Within a Wetland?	(Circle)
Remarks:			

Approved by HQUSACE 3/92

APPENDIX B: LIST OF VEGETATION

This list is adapted from the report on plant survey conducted by Robert Hobdy at the First Wind project site in April 2007. It lists all the species found during the April 2007. The "X" in the second column indicates the species that were found by SWCA during the survey on June 4, 2008. The "XX" indicates the species that were not listed in the April 2007, but were found during the wetland plant survey on June 4, 2008.

Scientific name	Hawaiian, Common name(s)	Found on 6/4/2008	Wetland indicator	Status	Abundance in 4/2007
FERNS					
LINDSAEACEAE (Lindsaea Family)					
Sphenomeris chinensis (L.) Maxon	pala'ā		FAC*	I	rare
NEPHROLEPIDACEAE (Sword Fern Family)					
<i>Nephrolepis exaltata</i> (L.) Schott subsp. <i>hawaiiensis</i> W.H.Wagner	ni'ani'au		FAC*	Ш	rare
POLYPODIACEAE (Polypody Fern Family)					
Phymatosorus grossus (Langsd. & Fisch.) Brownlie	laua'e	x		N	rare
CONIFERS					
PINACEAE (Pine Family)					
Pinus caribaea Morelet	Caribbean pine			N	rare
MONOCOTS					
AGAVACEAE (Agave Family)					
Agave sisalana Perrine	sisal	X		N	rare
Cordyline fruticosa (L.) A. Chev.	ki	x		Р	rare
ARECACEAE (Palm Family)					
Cocos nucifera L.	niu	х	FACU	Р	rare
Phoenix x dactylifera	hybrid date palm	x		N	rare
CYPERACEAE (Sedge Family)					
Cyperus rotundus L.	nut-sedge		FACU	N	rare
POACEAE (Grass Family)					
Andropogon virginicus L.	broomsedge		FACU	N	rare
<i>Brachiaria mutica</i> (Forssk.) Stapf	California grass		FACW	N	rare
Chloris barbata (L.) Sw.	swollen fingergrass			N	rare
Chloris divaricata R.Br.	stargrass			N	uncommon
Chrysopogon aciculatus (Retz.) Trin.	pi'i pi'i			I	uncommon
Cynodon dactylon (L.) Pers.	Bermuda grass		FACU	N	uncommon

_					
Dactyloctenium aegytium (L.) Willd.	beach wiregrass			N	rare
<i>Digitaria ciliaris</i> (Retz.) Koeler	Henry's crabgrass		FAC	N	uncommon
Digitaria insularis (L.) Mez ex Ekman	sourgrass	Х	FACU	N	abundant
Eleusine indica (L.) Gaertn.	wiregrass		FACU-	N	uncommon
Eragrostis amabilis (L.) Wight & Arnott	Japanese lovegrass			N	rare
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass			N	rare
Panicum maximum Jacq.	Guinea grass	X	FACU	N	uncommon
Paspalum conjugatum Bergius	Hilo grass		FAC+	N	rare
Paspalum dilatatum Poir.	Dallis grass		FACU	N	uncommon
Paspalum fimbriatum Kunth	Panama paspalum		FAC	N	rare
DICOTS					
ACANTHACEAE (Acanthus Family)					
Asystasia gangetica (L.) T.Anderson	Chinese violet	X		N	common
AMARANTHACEAE (Amaranth Family)					
Achyranthes aspera L.	chirchita			N	uncommon
Alternanthera pungens Kunth	khaki weed			N	rare
Amaranthus spinosus L.	spiny amaranth	X	FACU-	N	uncommon
Amaranthus viridis L.	slender amaranth		FAC	N	rare
ANACARDIACEAE (Mango Family)					
Magnifera indica L.	mango		FACU	N	rare
Schinus terebinthifolius Raddi	Christmas berry	x	FACU-	N	common
APIACEAE (Parsley Family)					
Centella asiatica (L.) Urb.	Asiatic pennywort	Х	FAC	N	rare
Ciclospermum leptophyllum (Pers.) Sprague	fir-leaved celery		NI	N	rare
ASTERACEAE (Sunflower Family)					
Acanthospermum australe (Loefl.) Kuntze	spiny bur			N	rare
Ageratum conyzoides L.	maile hohono		FAC*	N	uncommon
Bidens alba (L.) DC	common beggarticks	x		N	common
Calyptocarpus vialis Less.	straggler daisy			N	uncommon

	Ι. Τ			1	
Conyza bonariensis (L.) Cronquist	hairy horseweed	x		N	rare
Crassocephalum crepidioides	red flower ragleaf		546		
(Benth.)S.Moore Cyanthillium cinereum (L.) H. Rob.	little ironweed		FAC	N	rare
Emilia fosbergii Nicolson	red pualele			N N	rare
Pluchea carolinensis (Jacq.)				IN	rare
G.Don	sourbush	X		N	common
Pluchea indica (L.) Less.	Indian fleabane		FAC*	N	rare
Pluchea x foxbergii T.S. Cooper & M.M. Galang.		ХХ	FAC*	N	uncommon
Synedrella nodiflora (L.) Gaertn.	nodeweed		FAC*	N	rare
Verbesina encelioides (Cav.) Benth.&Hook.	golden crown- beard		FACU-	N	rare
Xanthium strumarium L.	cocklebur	Х	FACU	N	uncommon
BIGNONIACEAE (Bignonia Family)					
<i>Spathodea campanulata</i> P.Beauv.	African tulip tree			N	rare
BORAGINACEAE (Borage Family)					
Heliotropium procumbens Mill.	clasping heliotrope			N	rare
BRASSICACEAE (Mustard Family)					
Lepidium virginicum L.	peppergrass			N	rare
CARICACEAE (Papaya Family)					
Carica papaya L.	papaya	Х		N	rare
CASUARINACEAE (She-oak Family)					
Casuarina equisetifolia Stickm.	common ironwood	x		N	uncommon
CHENOPODIACEAE (Goosefoot Family)					
Chenopodium murale L.	'aheahea		FACU	N	rare
CONVOLVULACEAE (Morning Glory Family)					
<i>Ipomoea obscura</i> (L.) Ker- Gawl.				N	rare
COMMELINACEAE					
Commelina diffusa N.L. Burm.,	honohono	xx	FACW	N	rare
EUPHORBIACEAE (Spurge Family)					
Aleurites moluccana (L.) Willd.	kukui	x		P	rare

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Chamaesyce hirta (L.) Millsp.	hairy spurge	X		N	rare
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	x		N	rare
Chamaesyce prostrata (Aiton.) Small	prostrate spurge			N	rare
Macaranga tanarius (L.) Mull. Arg.	parasol leaf tree	х		N	common
Phyllanthus debilis Klein ex Willd.	niruri			N	uncommon
Ricinus communis L.	Castor bean	х	FACU	N	rare
FABACEAE (Pea Family)					
Acacia confusa Merr.	Formosa koa			N	rare
Acacia farnesiana (L.) Willd.	klu			N	uncommon
Chamaecrista nictitans (L.) Moench	partridge pea			N	uncommon
Crotalaria incana L.	fuzzy rattlepod			N	rare
Crotalaria pallida Aiton	smooth rattlepod			N	rare
Crotalaria retusa L.	rattleweed			N	rare
Desmanthus pernambucanus (L.) Thellung	slender mimosa			N	uncommon
Desmodium incanum DC.	ka'imi clover			N	uncommon
Desmodium triflorum (L.)	three-flowered beggarweed	х	FACU*	N	rare
Erythrina variegata L.	tiger claw			N	rare
Indigofera hendecaphylla Jacq.	creeping indigo			N	rare
Leucaena leucocephala (Lam.) de Wit	koa haole	x		N	abundant
Macroptilium lathyroides (L.) Urb.	wild bean			N	rare
Medicago lupulina L.	black medick			N	rare
Mimosa pudica L.	sensitive plant	х	FACU	N	uncommon
Neonotonia wightii (Wight&Arnott) Lackey	glycine			N	rare
Samanea saman (Jacq.) Merr.	monkeypod	X		N	rare
Senna occidentalis (L.) Link	coffee senna	X		N	uncommon
Senna surratensis (N.L.Burm.) H.Irwin&Barneby	kolomona	x		N	common
Stylosanthes fruticosa (Retz.) Alston	shrubby pencilflower			N	uncommon
LAMIACEAE (Mint Family)					
Leonotis nepetifolia (L.) R.Br.	lion's ear	X	NI	N	uncommon
Ocimum gratissimum L.	wild basil			N	rare
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MALVACEAE (Mallow Family)					
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	х		N	rare
Malva parviflora L.	cheeseweed			N	rare
Malvastrum coromandelianum (L.) Garcke.	false mallow		FACU	N	uncommon
Sida ciliaris (L.) D.Don	fringed fan petals	х		N	uncommon
Sida rhombifolia L.	Cuban jute	X	FACU	N	uncommon
Sida spinosa L.	prickly sida		NI	N	uncommon
Hibiscus tiliaceus L.	hau	XX	FACW	I	rare
MELASTOMATACEAE (Melastoma Family)					
Clidemia hirta (L.) D.Don	Koster's curse	X	FACU	N	rare
MENISPERMACEAE (Moonseed family)					
Cocculus trilobus (Thunb.) DC	Huehue	xx		I	
MORACEAE (Fig Family)					
Ficus macrophylla Desf. ex Pers.	Moreton Bay fig	x		N	rare
Ficus microcarpa L.fil.	Chinese banyan	X		N	rare
<i>Ficus platypoda</i> A.Cunn.ex Miq.	rock fig			N	uncommon
MYRSINACEAE (Myrsine Family)					
Ardisia elliptica Thunb.	shoebutton ardisia		FACU	N	rare
MYRTACEAE (Myrtle Family)					
Pimenta diocia (L.) Merr.	allspice	X		N	common
Psidium cattleianum Sabine	strawberry guava	X	FACU	N	rare
Psidium guajava L.	guava	Х	FACU	N	uncommon
Syzygium cumini (L.) Skeels	Java plum	X		N	uncommon
NYCTAGINACEAE (Four- o'clock Family)					
Bougainvillea spectabilis Willd.	bougainvillea			N	rare
OXALIDACEAE (Wood Sorrel Family)					
Oxalis corniculata L.	'ihi'ai		FACU	Р	uncommon
Oxalis debilis Kunth	pink wood sorrel			N	rare
PASSIFLORACEAE (Passion Flower Family)					

Passiflora edulis Sims	passion fruit	X		N	rare
Passiflora suberosa L.	corkystem			IN	rare
	passion flower			N	uncommon
PHYTOLACCACEAE (Pokeweed Family)					
Rivina humilis L.	coral berry			N	uncommon
PIPERACEAE (Pepper Family)					
Peperomia blanda Kunth var floribunda (Miq.) H.Huber	ala'alawainui	x		I	rare
PLANTAGINACEAE (Plantain Family)					
Plantago lanceolata L.	narrow-leaved plantain		FACU	N	uncommon
PLUMBAGINACEAE (Plumbago Family)					
Plumbago zeylanica L.	'ilie'e	x		I	rare
POLYGALACEAE (Milkwort Family)					
Polygala paniculata L.	milkwort		FACU*	N	rare
POLYGONACEAE (Buckwheat Family)					
Antigonon leptopus Hook & Arnott	Mexican creeper			N	rare
Rumex obtusifolius L.	bitter dock		FAC	N	rare
PRIMULACEAE (Primrose Family)					
Anagallis arvensis L.	scarlet pimpernel			N	rare
ROSACEAE (Rose Family)					
Osteomeles anthyllidifolia (Sm.) Lindl.	u'ulei	X		I	rare
RUBIACEAE (Coffee Family)					
Morinda citrifolia L.	noni	X	NI	Р	rare
Spermacoce assurgens Ruiz & Pav.	buttonweed			N	rare
RUTACEAE (Rue Family)					
Citrus aurantiifolia (Christm.) Swingle	lime			N	rare
SAPOTACEAE (Sapodilla Family)				7.5	1 3.1 5
Chrysophyllum oliviforme L.	satin leaf			N	uncommon
SOLANACEAE (Nightshade Family)					
Capsicum frutescens L.	chili pepper			N	rare
Solanum americanum Mill.	popolo			I	rare
Solanum torvum Sw.	pea aubergine			N	common
STERCULIACEAE (Cacao					

Family)					
Waltheria indica L.	'uhaloa	Х		I	uncommon
THYMELAEACEAE ('Akia Family)					
Wikstroemia oahuensis (A. Gray) Rock	'akia	x	FAC	E	uncommon
TILIACEAE (Linden Family)					
<i>Triumfetta rhomboidea</i> Jacq.	diamond burrbark			N	rare
Triumfetta semitriloba Jacq.	Sacramento bur			N	uncommon
VERBENACEAE (Verbena Family)					
Lantana camara L.	lantana	X		N	common
Stachytarpheta cayennensis (Rich.) Vahl	nettle-leaved vervain			N	uncommon
Stachytarpheta jamaicensis (L.) Vahl	Jamaican vervain	x	FACU*	N	common
Verbena litoralis Kunth.	ha'u owi	Х		N	rare